*[Examiner] Regarding claim 15, it is not clear what applicant intends to encompass with the limitation of the third harmonic generation, because the limitation is repeated, it is not clear if only one is to be selected.*

【Argument 1】 In step (3) and (4) of claim 15, there are clearly two physics situations or terms, one is "third harmonic generation", and the other one is "third harmonic generation with resonant harmonic generation". Each of them is of identity and does not lead to confusion over the intended scope of claim 15, particularly considering this claim is an end dependent claim. As a further explanation, it would not be difficult for people to identify "water" and "water with salt".

*[Examiner] Regarding claim 15, it is not clear what applicant intends to encompass with the limitation of the frequency mixing, because the limitation is repeated, it is not clear if only one is to be selected.*

【Argument 2】 Same as that shown in Argument 1.

Response To Claim Rejections - 35 U.S.C. § 103

*[Examiner] Claim 10 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Siebert (PN 3,582,815).*

Please note that the same rejection was presented in the Office Action of Non-Final Rejection dated 11-06-2000 and mailed 11-09-2000 and later was released in view of the applicant's reply dated 01-03-2001, particularly in the section 2 of the reply.

In fact, there has been a misunderstanding about the physics meaning expressed by the sentence in the step (4) of Claim 10, particularly to the physics meaning and physics configuration about the so-called "thin gain region", or "said gain region within a narrow area". Actuality, the thin gain region is slice-shape or disk-shape rather than line-shape. The relevant physics meaning and configuration about the term "thin gain region" should be recognized and understood by those of ordinary skill in the art. As repeatedly presented in the above patent application, the approach in the step (4) of Claim 10 has clearly been declared for the sole purpose of eliminating or minimizing the spatial hole-burning effect so as to promote SLM

operation. Obviously, a line-shaped gain region as described in the cited patent of Siebert (PN 3,582,815) is not able to provide such a significant function.

As a further explanation, in the approach of claim 10 a formation of wavelength selectivity with low insertion losses is used in cooperation with a thin gain zone that leads to SLM operation. Therefore, the laser arrangement clearly consists of three limitations in claim 10:

(1) a laser gain region is very thin;

(2) the thin gain region is located adjacent to or in contact with an end laser cavity mirror; and

(3) a formation of wavelength selectivity with low insertion losses is placed within a laser cavity, such as a low resolving-power spectral filter, including Lyot filter or low-finesse etalon or the like.

The function of the limitation (1) and (2) in the laser arrangement is to create a circumstance to promote SLM operation. In such a circumstance, all possible longitudinal modes have about an equal chance to extract the available gain. One lucky mode that begins to oscillate first wins the "mode-competition" and deprives the others of the gain needed to oscillate, thereby encouraging or enforcing single-longitudinal-mode (SLM) operation.

On the other hand, the effect caused by a thin gain region in contact with an end mirror is equivalent to that caused by short cavity configurations, in which those potential oscillating longitudinal modes are separated substantially. In such a case, the required resolving-power of a frequency-selective form will be largely relaxed and it becomes possible to use a formation such as a spectral filter with low insertion losses in realizing single-mode operation. A low resolving-power spectral filter would be relative to a low frequency-selective loss. Please also refer to the relevant content about the pre-narrowband approach or the pre-narrowband operation in the parent patent of U.S. Pat. No. 5,515,394.

**[Note 1]** Regular CW solid-state lasers with intracavity frequency doubling usually exhibit chaotic fluctuations in the visible output. It has been well known and called as the "green problem" since many years ago. In other words, with the use of a regular laser cavity, a visible CW solid-state laser must encounter the "green problem". Such a commercial laser with a solution of the green problem would mainly fall into four categories defined by:

(1) claim 10 above (single mode operation);

(2) Spectra-Physics' patent of U.S. Pat. No. 5,446,749 (multi-axial-mode operation with a long cavity);

(3) The products made by Q. Zheng, Changchun Institute of Optics, Fine Mechanics and Physics, Chinese Academy of Sciences (multi-axial-mode operation with a regular cavity); and

(4) Dr. Thomas Baer's patent of U.S. Pat. No. 5, 627,849 (two or a few mode operation).

And there is almost no other choice. In other words, there are no more categories related to a patentable approach for solving "green problem".

**[Note 2]** G. J. Kintz and T. Baer in their paper of "Single-Frequency Operation in Solid-State Laser Materials with Short Absorption Depths," IEEE J. QE-**26**(1990)9, 1457, describe an approach as follows:

"The single mode operation can be realized by placing a homogeneously broadened gain medium with a short absorption depth at an end mirror of a cavity. All the longitudinal modes have a common spatial node at the surface of the mirror, and access to the same population inversion since in this narrow excited region. The mode with the highest cross section for stimulated emission will oscillate first, saturation the population inversion and reducing the gain of the medium to the threshold gain of this first mode. This modification of the population inversion reduces the gain available to the other longitudinal modes. Other cavity modes with lower cross sections can not reach threshold since they use the same population distribution as the highest gain mode. --- At larger distances from the end mirror, the longitudinal modes begin to dephase spatially, and the individual modes begin to access different inversion populations."

**[Note 3]** Please further refer to A. E. Siegman, Lasers. Mill Valley, CA; Univ. Sci., 1986, pp.465-466.

## In addition

The above reissue patent application should obviously been recognized as the key prior are for the US Patent Application (SN 11/419,021 or Publication 20070030878) "Laser arrangement and method for the generation of a multimode operation with intracavity frequency doubling", hereinafter '0878.

In the examination process of '0878 the arguments of 5-5-08 presented by the applicant, Guenter Hollemann, are ambiguous, puzzling and misleading with the use of some confused concepts in physics, resulting in difficulties for the Examiner Kinam Park. In fact, their patent application at most is a disclosure for a self-defined physics phenomenon, rather than an invention, even though such a disclosure also is meaningless in physics. Such as "The precise wavelength distance of the center wavelengths of the two spectral regions is provided as part of the claimed invention." Actually, the parameters of an etalon applied can easily and directly be determined with a relevant experimental setup by those of ordinary skill in the art.

Some language and physics term only have been used by themselves in the world, like "the two multimode spectral regions" and "to prevent oscillation of one of the two multimode spectral regions." In fact, their laser arrangement has a natural tendency leading to SLM operation, rather than "a multimode operation." (Please refer to Note 2 above and Note 4 below)

In fact, '0878 should be easily and obviously rejected under 35 U.S.C. 103(a) as being unpatentable over the above reissue patent application and its original U.S. Pat. 6,373,868. In view of the page 3 in this letter, in the application of '0878 their disk laser arrangement extrinsically or inherently possesses each of the limitations claimed in claim 10, they are

(1) a laser gain region is very thin;
(2) the thin gain region is located adjacent to or in contact with an end laser cavity mirror; and
(3) a formation of wavelength selectivity with low insertion losses is placed within a laser cavity, such as a low resolving-power spectral filter, including Lyot filter or low-finesse etalon or the like.

It is pointed out in MPEP § 2133.03(c) that "If a product that is offered for sale inherently possesses each of the limitations of the claims, then the invention is on sale, whether or not the parties to the transaction recognize that the product possesses the claimed characteristics."

**[Note 4] A Clear Picture and Description**

A solid-state laser gain medium with a limit length is located within a standing-wave laser cavity. Normally several laser longitudinal modes with different wavelengths are able to

oscillate. They can be named as wavelength A, wavelength B, wavelength C and so on. Each of them has own corresponding standing wave pattern within the laser gain medium and laser cavity.

When a laser operation under spatial hole burning, one oscillating longitudinal mode or wavelength usually can not occupy an entire gain region spatially. Typically around half gain region is not accessible to the oscillating longitudinal mode or wavelength. Therefore, the unoccupied gain region is readily available to other laser wavelengths. (Also see Note 2)

Supposed the wavelength A oscillate initially then its corresponding standing-wave pattern occupies around half of the gain region spatially and to leave another half around of the gain region to others.

If a wavelength B is the same as wavelength A so that the gain region is nothing left for it, because the standing-wave pattern of wavelength B now is overlapping the standing-wave pattern of wavelength A. In such case, both wavelengths A and B access the same inversion populations and one calls them as "**in phase**".

However, it is important to know that, the wavelength B also could be different with wavelength A but with the same "in phase" situation above. That is, its corresponding standing-wave pattern is able to overlap the standing-wave pattern of wavelength A while the gain region is of a limited length and located some special positions in the laser cavity, typically adjacent to or in contact with an end laser cavity mirror. Please refer to U.S Pat. 4,809,291 to Byer and U.S Pat. 6,873,639 to Zhang, Part XIII for more information.

If a wavelength C is different with wavelength A and at same time its corresponding standing wave pattern occupies another half of the gain region spatially which is left by wavelength A, then the two corresponding standing wave patterns of wavelength A and C are spatially anti-correlated, i.e., their peaks and nodes are shifted and altered. For such a case one calls the wavelength A and C as "**out of phase**" and they have a spatially anti-correlated relationship. As a result, they almost occupy full gain region and access two totally different parts of inversion populations within the gain region. The gain region hence is almost totally used by the wavelength A and C and nothing left to other laser wavelengths. However, such a case would never occur while a thin gain region is adjacent to or in contact with an end laser cavity mirror.

On the other hand, while wavelength B is different from wavelength A and at same time its standing-wave pattern is not overlapping or anti-correlating the standing-wave pattern of wavelength A within the gain region, one calls them as **dephase** spatially. In contrast to above the individual modes begin to access different inversion populations. (Also see Note 2)

It is important to point out that whatever the difference between wavelength A and wavelength B is big or small, their corresponding standing-wave patterns within the gain region can be in phase, or dephase, or out of phase. It solely depends on the location of the gain region within the laser cavity as well as the length of the gain region.

【Conclusion】 while a thin gain region is adjacent to or in contact with an end laser cavity mirror, the entire gain region is not fully accessible to a single oscillating longitudinal mode or wavelength, so that there always exist some unused gain region readily for lasing other wavelengths. In order to realize a steady single longitudinal mode or single frequency operation, therefore, it is necessary to insert an etalon so as to prevent other laser wavelength to oscillate.

Finally, please let applicant to submit the following three new documents along with this letter, applicant respectfully requests the examiner to allow entering them.

1) Supplemental Oath/Declaration. (1 page)

2) An amendment paper of "Changes of Claims Shown by Markings". (3 pages)

*Note: There are some minor word-error-related corrections for the pending claims 10, 13 and 15 in compliance with the Office Action dated August 29, 2008.*

3) Statement of Status/Support for all Changes to the Claims and Claims 10-15. (4 pages)

*Note: This is the clean version of the set of the pending claims 10 –15 after the current amendment.*

Respectfully submitted,

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